Monsoon Winds and Floods Observed by SeaWinds Scatterometer on QuikSCAT

S. V. Nghiem, W. T. Liu, W.-Y. Tsai, and X. Xie
Jet Propulsion Laboratory, MS 300–235, California Institute of Technology
4800 Oak Grove Drive, Pasadena, CA 91109, USA

We present, for the first time, composite time-series observations of monsoon floods over land on the continental scale together with wind fields over oceans. Both wind and flood results are derived from Ku-band backscatter measurements by the spaceborne SeaWinds scatterometer. The launch of the wideswath scatterometer on the QuikSCAT satellite last June (1999) was at the time when strong cyclones and severe widespread floods started to occur, early this year, over various countries in the Asian summer monsoon region. Heavy monsoon rains since June devastated large areas of Asia this summer.

The basis for the mapping of flood inundated urban and crop-land areas is the enhancement of the horizontal-polarization backscatter compared to the vertical-polarization return. In particular for the QuikSCAT/SeaWinds scatterometer, its very wideswath and the separation in incidence angles of the inner horizontal and the outer vertical beams make the sensor appropriate for the flood mapping simultaneously over many countries in the Asian monsoon flood region. Such an application to the large-scale flood mapping is unprecedented in coverage and temporal resolution, which are important because of the extensive spatial extent and the transient short-time scale of monsoon flooding events. For ocean surface wind fields, wind vectors are routinely derived from SeaWinds data and wind products are available daily.

QuikSCAT/SeaWinds backscatter data acquired over Asia show extensive floods in Anhui, Zhejiang, Jiangsu, and other provinces in the Yangtze river basin. According to reports from the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA), 100 million people in China were affected by this year's floods. QuikSCAT/Sea-Winds data over India reveal the North Bihar flood. Triggered by torrential monsoon rains, this flood was the worst in more than a decade and it affected 5 million people and inundated more than 2700 villages over 21 districts [*Agence France-Presse,* AFP Aug.-Sep. 1999]. Since July, the scatterometer flood mapping indicates the flood situation in India has been worsened and spanned extensive regions from West Bengal, through Bihar, to Uttar Pradesh, and up to Himachal Pradesh. Later in October 1999, QuikSCAT/SeaWinds wind and flood time-series observations show a cyclone forming over ocean, moving toward land, making landfall, and causing extensive floods in the state of Orissa in eastern India making 10 million people homeless. In Bangladesh, the flooding got worse as indicated by QuikSCAT/SeaWinds data. Further intensification of the monsoon brought heavy downpours throughout most of Bangladesh which led to significant rises in major rivers, floods, and severe erosion [*International Federation of Red Cross (IFRC),* Sep. 1999]. Monsoon floods are also observed over many Asian countries including Nepal, Pakistan, Vietnam, Laos, Thailand, and Cambodia with the worst flooding in 20 years.

Finally, why is it important to map a flood when it already occurs? This is exactly when the crucial efforts of flood relief start. By delineating the flood areas, one can integrate the population density over the affected areas and can calculate the number of people affected. Timely flood mapping gives information on the "when, where, how large, and how many", which are important to flood relief organization such as UN-OCHA, IFRC, and national and local authorities to determine and allocate limited resources (food, medicine, and personel) to flood areas. Furthermore, the flood mapping is important for regional hydrological studies, and for agricultural and urban planning and development.